

REMARKS

This amendment is being filed in response to the Office Action dated April 19, 2006. In that office action, claims 9 and 32 were objected to, claims 1-4, 6-15, 18-20, 27-28, 30-39 and 41 were rejected under 35 USC §102(b), and claims 5, 16-17, 29 and 40 were rejected under 35 USC 103(a). Claims 1, 14, 33 and 39 are currently being amended.

Election / Restriction –

In the previous Office Action, it stated “Applicant’s election with traverse of group I, claims 1-20 and 27-32, in the reply filed on 4/10/2006 is acknowledged.” The Applicants respectfully point out that the election was provisionally made with traverse to claims 1-20 and 27-41, not claims 1-20 and 27-32.

Objection –

Claims 9 and 32 were objected to in the previous Office Action on the basis that they “...recite four retention features specifically spaced from each other, however the specific number of retention features has yet to be claimed.” The Applicants respectfully traverse this objection on the grounds that claims 9 and 32 are not limited to a *particular number* of retention features, but instead call for at least four retention features located at the positions specified in those claims.

Claim 8 is dependent upon claim 1 and calls for a plurality of retention features, wherein one or more retention features from that plurality are located at a first axial position, and one or more retention features from that plurality are located at a second axial position. Claim 9 depends from claim 8, and further

specifies that first and second retention features are located at the first axial position and have a certain circumferential spacing, and that third and fourth retention features are located at the second axial position and have a certain circumferential spacing. Accordingly, the Applicants are confused as to what type of 'appropriate correction' is being requested, and respectfully ask that the Examiner more fully explain this objection.

Rejection Under 35 USC §102(b) –

Claims 1-4, 6-15, 18-20, 27-28, 30-39 and 41 stand rejected under 35 USC §102(b) as being anticipated by Shibata et al. (US Patent No. 5,982,080). In view of the amendments to claims 1, 14, 33 and 39, and at least for the reasons stated below, the Applicants respectfully traverse this rejection and request its reconsideration.

Claims 1-13 –

Neither Shibata nor any of the other applied references discloses a retention feature that extends generally radially into a noble metal tip from *an exposed surface of the noble metal tip*, as recited in amended claim 1.

It is clearly seen in FIGS. 2 and 3 of the present application that each of the retention features 44, 46, 60 and 62 extends into noble metal tip 20 in a generally radial manner, and does so from an exposed surface of the noble metal tip. This type of configuration enables the retention features to receive molten electrode and/or noble metal material during an attachment process, and creates a mechanical interlock that improves the strength of the bond between the noble metal tip and the electrode. Shibata discloses no such retention features.

Turning now to the Shibata patent, fused portion 7 does not constitute the retention feature called for in claim 1 for a number of reasons; not least of which is the fact that it *does not extend from an exposed surface of the noble metal tip*.

To the contrary, fused portion 7, which is simply the result of a laser welding operation that irradiates an outer surface of center electrode 3 (see arrow A in FIG. 5C), extends from an outer surface of *the center electrode front end portion 3a*, not an exposed surface of the noble metal tip. Thus, the patent to Shibata clearly fails to disclose or to even suggest providing a retention feature extending from an exposed surface of a noble metal tip, as called for in amended claim 1.

Moreover, assuming arguendo that fused portions 7 are retention features, the Shibata patent still fails to disclose the plurality of retention features called for in dependent claims 8. The Applicants respectfully disagree with the Examiner's interpretation that "...Shibata et al ('080) teach the tip further comprises a plurality of said retention features (7), and wherein one or more of said features are located at a first axial position along said tip and one or more of said features are located at a second axial position along said tip, said first and second axial positions being spaced from one another (see figure 1b)." According to Shibata, figure 1b is a plan view of the chip in accordance with a first embodiment of the present invention.¹ That same embodiment of the chip is shown in figure 1a, which clearly shows that the fused portions 7 are, in fact, located at the same axial position. Claims 9 and 10 depend from claim 8, and thus include the limitations of that base claim.

Accordingly, the Applicants respectfully request that the Examiner reconsider this rejection and allow independent claim 1 and dependent claims 2-13.

Claims 14-20 and 27-32 –

The Shibata reference fails to disclose or to even suggest providing a center electrode assembly comprising a noble metal tip that includes a *preformed retention feature* and a *fusion layer extending into the preformed retention feature*, as recited in amended claim 14. This contention is at least based on the following reasons.

First, Shibata makes no indication whatsoever that *a preformed retention feature* could be used, as now called for in amended claim 14. In the last office action, it was stated that Shibata includes "...a retention feature extending generally radially inwardly into said noble metal tip (7; figure 1a; column 4 lines 20-31) at a location that is adjacent said attachment end (see figure 1a)."² In the Applicants' opinion, the 'retention feature' being referred to is simply a fused portion 7 that is formed when chip 5 is laser welded to the front end portion 3a of center electrode 3 and is not a *preformed* retention feature, as stated in claim 14. With reference to Shibata, it states that:

Each fused portion 7 bridges the leg portion 51 of the chip 5 and the front end portion 3a of the central electrode 3. The fused portions 7 are formed by later-described laser welding.³ (emphasis added)

In contrast to the teachings of the present application, fused portion 7 is simply the result of chip 5 being laser welded to center electrode 3 and is not a *preformed* feature. This position is supported by FIG. 5A of Shibata, which unambiguously shows a chip 5 having no retention features as it is being lowered into hole 321.

Second, Shibata shows a traditional laser welded joint formed between center electrode 3 and chip 5, and fails to show *a fusion layer extending into a preformed retention feature*, as defined in claim 14. It should be understood that the various sectional views shown in Shibata are simply illustrations of the different spark plug components, and are not meant to be exact replicas of actual welded joints. It will be appreciated by those skilled in the art, for instance in FIG. 1A, that the notched-out sections in chip 5 that are the result of the illustrated fused portions 7 are not actually recesses in the chip. Rather, fused portions 7 represent an area of chip 5 where a laser has melted and joined the center electrode and chip materials together into an amalgam-like region. Put differently, fused portion 7 is simply a traditional laser weld formed between the center electrode and the chip, whereas the preformed retention feature recited in

¹ US Patent No. 5,982,080; col. 6, lines 30-32

² Office Action dated April 19, 2006

³ US Patent No. 5,982,080; col. 8, lines 5-8

claim 14 is a definitive feature designed to receive a fusion layer so that the noble metal tip is locked to the center electrode.

Furthermore, the Applicants respectfully traverse the rejection of claims 15 and 19. Claim 15 is traversed on the same grounds as articulated above in connection with claim 8. As for claim 19, the Examiner stated in the previous Office Action, “...Shibata ('080) teach the center electrode component (3) is comprised of a nickel-based material (column 7 lines 17-30; *specifically Inconel 600*) having a thermal conductivity of greater than 30 W/mK during normal spark plug operating temperatures (*it is known that Inconel[sic] 600 has a thermal conductivity below 30 W/mK during normal spark plug operating temperatures...*).” (Emphasis added.) In view of the Examiner's statements that Shibata teaches the use of Inconel 600, and that Inconel 600 has a thermal conductivity below 30 W/mK during normal spark plug operation, the Applicants fail to see how claim 19 is anticipated by Shibata.

Therefore, for at least the reasons set forth above, it is respectfully requested that the Examiner reconsider this rejection and allow amended claim 14, as well as dependent claims 15-20 and 27-32.

Claims 33-38 –

Amended claim 33 calls for an electrode assembly having a noble metal tip locked to an electrode by material that: i) includes electrode material *without any significant amount of noble metal material*, ii) extends into one or more recessed retention feature(s), and iii) *conforms with the shape* of the recessed retention feature(s). Neither Shibata nor any of the other references discussed in the previous office action disclose such an electrode assembly.

As already explained, the fused portions 7 described in Shibata are weld joints made of both electrode and chip materials. Thus, Shibata fails to show a noble metal tip that is locked to an electrode by material that includes electrode material *without any significant amount of noble metal material*. As is

appreciated by skilled artisans, the further into the welded fused portion 7 of Shibata that one goes (that is, the closer to the pointed end 71), the higher the ratio of noble metal material to electrode material. Thus, the fused portion material that is located within the boundary of chip 5 does not include electrode material *without any significant amount of noble metal material*, as called for in claim 33. Quite the contrary, it is *largely made of noble metal material*. This is primarily attributable to the fact that the welding process used here, unlike the process disclosed in the present application, must melt significant sections of chip 5 in order to produce the laser welded joint that is fused portion 7. It should be appreciated, of course, that some degree of noble metal may melt and flow with the electrode material into the recessed retention features when using some embodiments of the present process, however, that amount is insignificant when compared to the electrode material.

In addition, Shibata makes absolutely no reference to any *recessed* retention features. As already explained in conjunction with claim 14, the notched-out sections in chip 5 are not actual recesses, but instead are representations of areas of the chip where a laser has melted and joined the center electrode and chip materials together into a commonly understood welded joint. Without recessed retention features, none of the applied references, including Shibata, disclose a noble metal tip that is locked to an electrode by material that ii) *extends into* one or more recessed retention feature(s) and iii) *conforms with the shape of* the recessed retention feature(s), as recited in claim 33.

Thus, it is the Applicants' opinion that claims 33-38 clearly recite subject matter that is patentable over the applied prior art, and the Applicants respectfully request that the Examiner reconsider this rejection and allow these claims.

Claims 39-41 -

As already established, Shibata neither discloses nor suggests providing a noble metal tip having one or more *preformed* retention features. Therefore, for at least the reasons stated above in connection with claim 14, it is the Applicants'

position that claims 39-41 recite patentable subject and the Applicants respectfully request that this rejection be reconsidered and that claims 39-41 be allowed.

Rejections Under 35 USC §103(a) –

Claims 5 and 29 stand rejected under 35 USC §103(a) as being unpatentable over Shibata in view of Osamura (US Patent No. 6,215,235), claims 16 and 17 stand rejected under 35 USC §103(a) as being unpatentable over Shibata, and claim 40 stands rejected under 35 USC §103(a) as being unpatentable over Shibata in view of Orjela et al. (US Patent Publication No. 2004/0239224). In light of the amendments to claims 1 and 14, and at least for the reasons stated below, the Applicants respectfully traverse this rejection and request its reconsideration.

First, the patent to Osamura shows no retention features and simply discloses a standard cylindrical shape noble metal tip being attached to the non-recessed end of a center electrode. Thus, at a threshold level, the Osamura patent does not make up for the deficiencies of Shibata, as discussed above.

Second, the Applicants do not consider the Orjela reference to be prior art. In fact, the current application claims priority back to the Orjela reference in question. If the Examiner disagrees, then the Applicants respectfully ask that the Examiner specifically identify the type of prior art that she believes the Orjela reference to be.

Conclusion –

In view of the foregoing, Applicants respectfully submit that all claims are in condition for allowance and therefore request reconsideration. The Examiner is

invited to telephone the undersigned if doing so would advance prosecution of this case.

The Commissioner is hereby authorized to charge Deposit Account No. 50-0852 for a one-month extension of time, as well as any other required fees, or to credit any overpayment associated with this communication.

Respectfully submitted,

REISING, ETHINGTON, BARNES, KISSELLE, P.C.

/Michael C. Adams/

Michael C. Adams
Registration No. 56,041
P.O. Box 4390
Troy, Michigan 48099
(248) 689-3500

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JDS/tak